Introduction to the Bridge Hydraulics Handbook

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Purpose

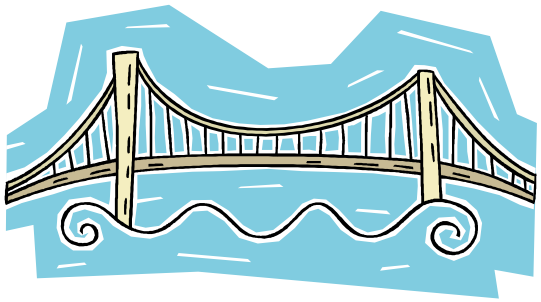
- ✓Provide an overview of the new Bridge Hydraulics Handbook (BHHB).
- ✓Discuss major findings from Quality Assurance Reviews (QARs)

Ch. 1 - Introduction

- ✓Intended as reference for designers
- ✓Guidelines for hydraulic analysis and design
- ✓Available online: http://www.dot.state.fl.us/rddesign/dr/Manualsandhandbooks.shtm

Ch. 2 - Project Approach and Miscellaneous Considerations

- ✓Hydraulic Conditions
  - ✓Identify flow type
- ✓Floodplain Requirements
  - ✓FEMA
  - ✓Other Agency
- ✓Design Frequencies



Ch. 2 - Project Approach and Miscellaneous Considerations Cont.

- ✓Clearances
- ✓Bridge Length Justification
- ✓Berms and Spill Through Abutment Bridges
- ✓Design Considerations for Dual Bridges
- ✓Design Considerations for Bridge Widenings
- ✓Structural Pier Protection Systems

Ch. 3 – Riverine Analysis

Riverine analysis applies to inland streams and rivers.

- ✓Data
- ✓Hydrology
- ✓Model Selection
- ✓Model Setup
- ✓Simulations

Ch. 3 – Riverine Analysis Cont.

Ch. 4 – Tidal Analysis

Analysis on a tidal or tidally influenced bridge should be performed by a qualified coastal engineer and include the following:

- ✓Data Requirements
- ✓Hydrology
- ✓Model Selection
- ✓Model Setup
- ✓Simulations
- ✓Wave Forces

Ch. 5 – Manmade Controlled Canals

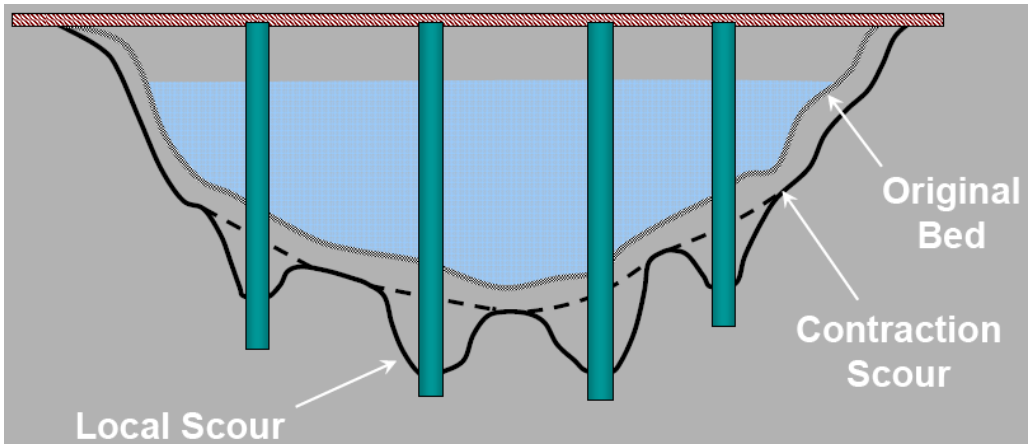
- Typical Characteristics:
  - ✓Have downstream control structure
  - ✓Do not flood out of bank
  - ✓Low design velocity
  - ✓Abutments will not encroach into cross section of the canal
- Allows for an abbreviated BHR

Ch. 5 – Manmade Controlled Canals Cont.

Ch. 6 – Bridge Scour

Bridge Scour:

- ✓Most common cause of bridge failure
- ✓Major factor contributing to total construction and maintenance costs of bridges
- ✓Hydraulic Engineering Circulars (HEC) 18 and 20

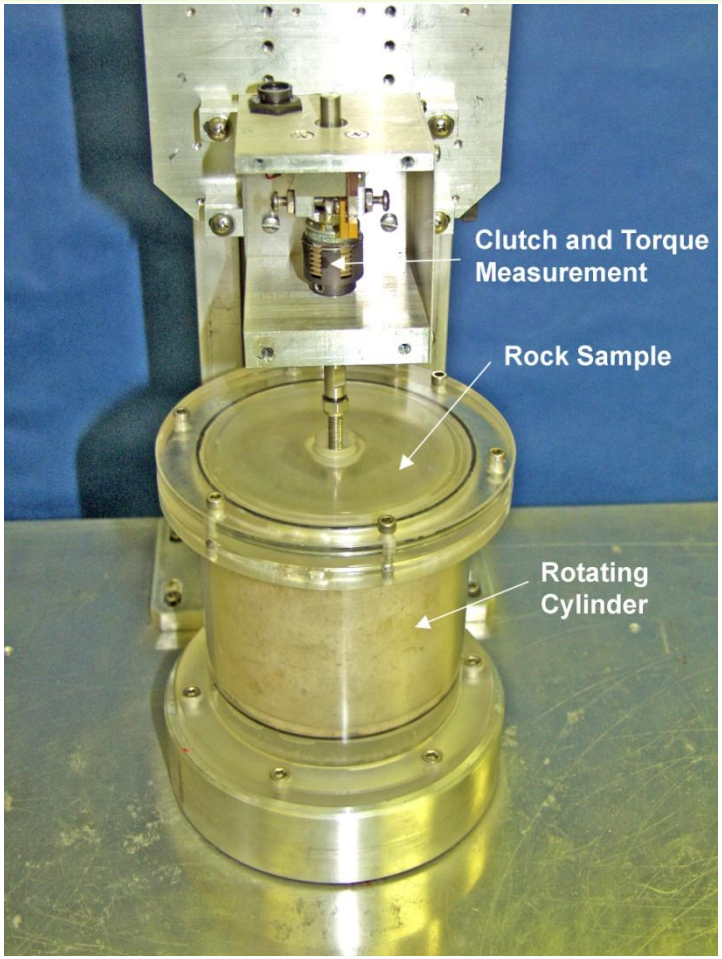


Ch. 6 – Bridge Scour Cont.

Scour estimates should include:

- ✓Scour Components
- ✓Scour Considerations for Ship Impact
- ✓Florida Rock/Clay Scour
- ✓Scour Countermeasures

Ch. 6 – Bridge Scour Cont.



Ch. 7 – Deck Drainage

Preferential order to drain the deck of a bridge:

1. Convey deck runoff to bridge end
2. Free discharging scuppers or inlets
3. Bridge inlet and pipe system

Ch. 7 – Deck Drainage Cont.

Ch. 8 – BHR Format and Documentation

FDOT Drainage Manual (Section 4.11.2) provides the minimum documentation that must be included into a BHR for:

- ✓Bridge and bridge culvert widening
- ✓Bridge culverts
- ✓Category 1 and 2 bridges

Ch. 8 – BHR Format and Documentation Cont.

Four components of Chapter 8:

- ✓BHR Preparation
- ✓BHR Process
- ✓Common Review Comments
- ✓Bridge Hydraulic Recommendation Sheet (BHRS)

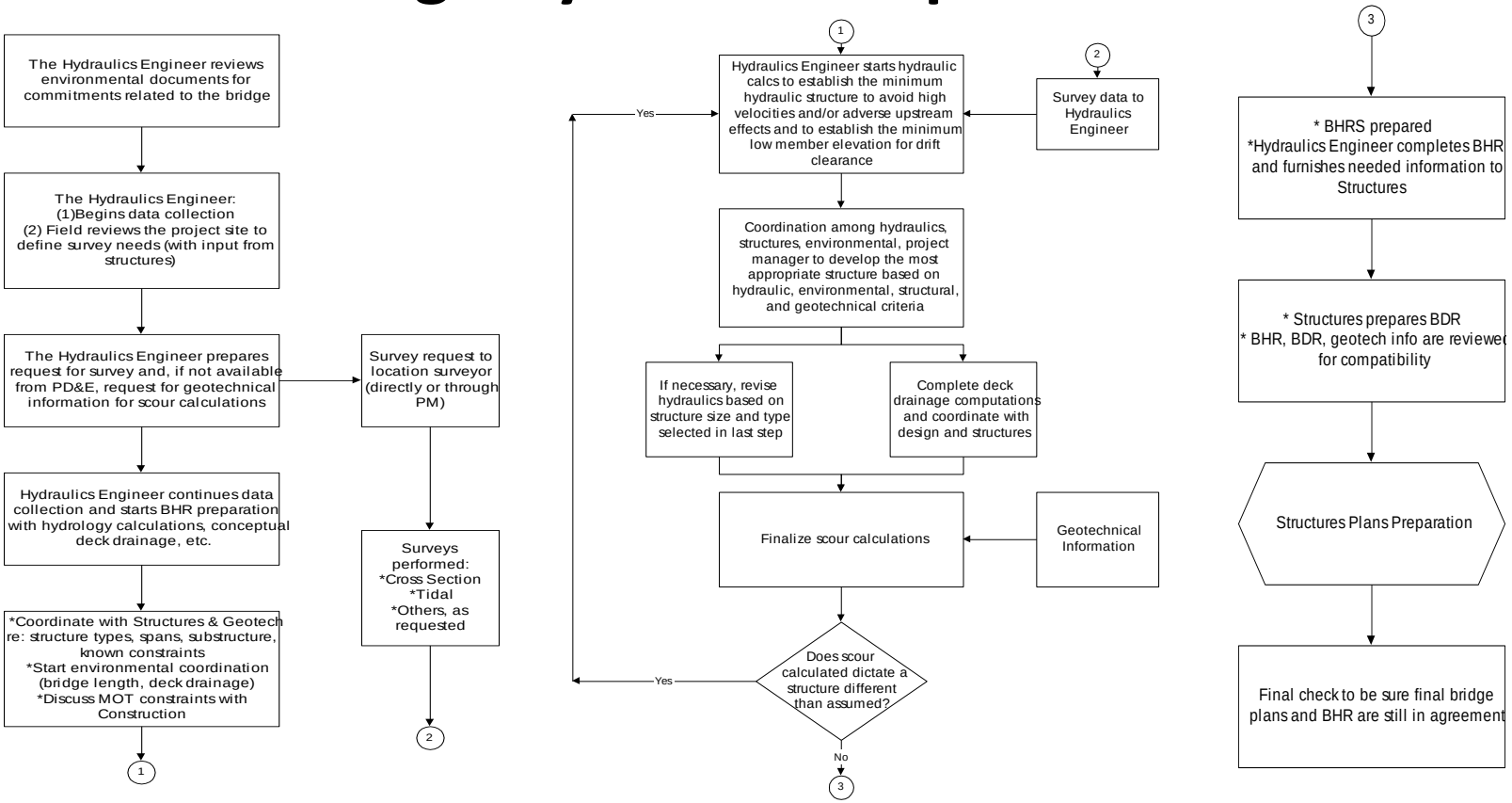
Ch. 8 – BHR Format and Documentation Cont.

BHR General Outline:

1. Executive Summary
2. Introduction
3. FEMA/Regulatory Requirements
4. Hydrology
5. Hydraulics
6. Scour
7. Deck Drainage
8. Appendices

Ch. 8 – BHR Format and Documentation Cont.

Bridge Hydraulics Report Process



Ch. 8 – BHR Format and Documentation Cont.

Common BHR Review Comments:

- ✓Bridge Location
- ✓Bridge Number
- ✓Relevant Datums
- ✓Modeling Procedures
- ✓Scour Calculation Procedures
- ✓Abutment Protection
- ✓Deck Drainage Discussion

Ch. 8 – BHR Format and Documentation Cont.

Common BHRS Review Comments

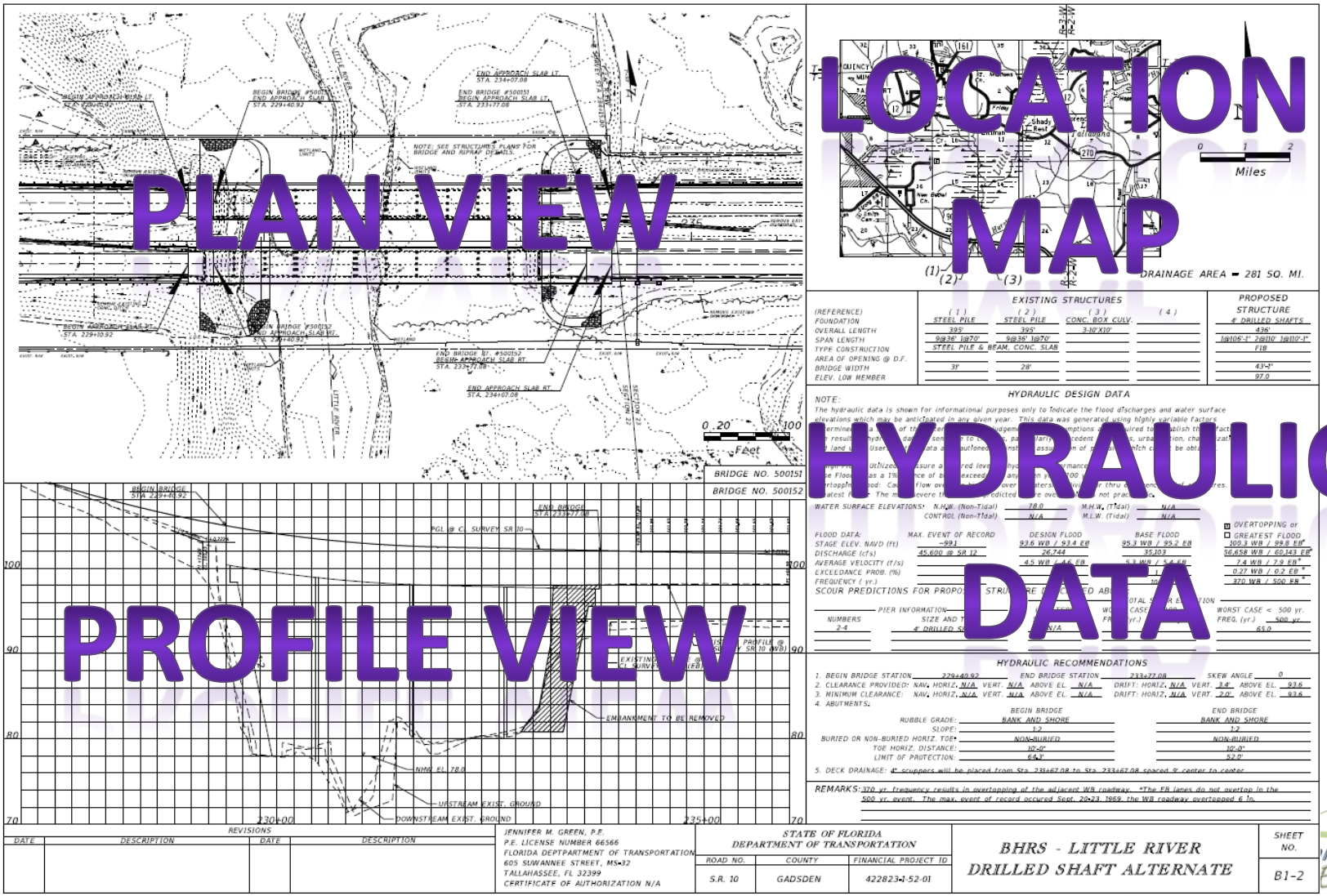
Plan View

- Stationing and Scale
- Existing Topography
- Label Water Body
- Flow Arrows
- Bridge Begin/End Station
- Abutment Limits
- Right-of-Way Lines

Profile View

- Stationing and Scale
- Existing Surveyed XS
- Proposed Roadway Profile
- Proposed Bridge
- Abutment Locations
- Design Flood Elevation
- NHW/MHW

Ch. 8 – BHR Format and Documentation Cont.



Ch. 8 – BHR Format and Documentation Cont.

Summary of BHR:

- ✓Clear and concise language
- ✓Graphics from public viewpoint
- ✓Consistent report format

2010-2012 QAR

- QAR: Quality Assurance Reviews
- Legislative mandate
- Plan varies by year(s)
- Current review:
  - In-House Category I BHRs
  - Consultant Category I BHRs
  - Category II BHRs
  - District QA/QC plan

Findings

- Documentation!
  - What design frequency?
    - ADT?
    - Evacuation Route?
  - Why varying from DM criteria?

low level nature of the bridge. The existing and proposed bridges are constrained by intersections at both ends of the bridge and therefore it was not possible to raise the profile further to provide the required vertical clearance. The deck of the bridge has a crowned typical

  - Executive summary requirements
    - DM 4.11 list

Findings

- Sheppard's Pier Scour Eq.
  - Total scour > 5ft
  - It's ok to have 0ft scour
- Deck drainage calculations
  - 10yr check for shoulder gutter on fill slope

Findings

- Evidence of field review
  - Photographs of findings
    - Channel condition
    - Abutments
  - NOT Bridge Inspection Report
  - NOT review of documents

Findings

- Category 2 Structures Submittals
  - Required review by CO
  - BHR included in BDR submittal
- Required by
  - DM 4.11.3 Document Processing → PPM
  - PPM Vol. 1 Chapter 26

What is Category 2?

- steel box girders,
- curved steel plate girders,
- span lengths equal to or greater than 170 feet,
- cast-in-place concrete box girder bridges,
- concrete segmental bridges,
- continuous post-tensioned concrete bridges with or without pretensioning,
- steel truss bridges,
- cable stayed bridges,
- movable bridges,
- depressed roadways,
- tunnels,
- Nonredundant foundations,
- substructures containing post-tensioned components,
- Straddle piers,
- integral caps,
- bridges designed for vessel collision,
- or any design concepts, components, details or construction techniques with a history of less than five (5) years of use in Florida.

Category 2 Processing

- The Structures Design Office has total project development and review responsibility for projects involving Category 2 Structures.
- 26.10 BHRS: Category 2 - State Structures Design Engineer concurrence required

Questions?

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